

**Notice of Allowability**

Application No.

10/518,391

Examiner

Matthew Landau

Applicant(s)

YOSHIDA ET AL.

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**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 8/23/2006.
2. ☒ The allowed claim(s) is/are 2-13.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some\* c) ☐ None of the:
- ☒ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☒ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached .
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
- (b) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statements (PTO/SB/08),  
Paper No./Mail Date 12/17/04
- ☐ Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
- ☐ Notice of Informal Patent Application
- ☐ Interview Summary (PTO-413),  
Paper No./Mail Date \_\_\_\_\_
- ☐ Examiner's Amendment/Comment
- ☒ Examiner's Statement of Reasons for Allowance
- ☐ Other \_\_\_\_\_

## **DETAILED ACTION**

### ***Election/Restrictions***

In light of Applicant's arguments in the reply filed August 23, 2006, the restriction requirement has been withdrawn.

### ***Drawings***

The drawings are objected to because Figure 2 is labeled as a "p-i-n type", however there is no insulator and the specification describes the embodiment as a "p-n junction type". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

*Allowable Subject Matter*

Claims 2-13 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding claim 2, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-type half-metallic ferromagnetic semiconductor and an n-type half-metallic ferromagnetic semiconductor which are joined together to create a p-n junction type low-resistance tunneling-magnetoresistance effect. Note that the specification distinguishes between a p-n junction type and a p-i-n type. In accordance with the specification, it is considered that a "p-n junction type" has no insulator between the p and n regions.

Regarding claim 3, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-type half metallic ferromagnetic semiconductor formed by doping Cr and a hole in a group II-VI compound semiconductor, and an n-type half-metallic ferromagnetic semiconductor formed by doping V and an electron in said group II-VI compound semiconductor, which are joined to form a p-n junction type low-resistance TMR diode.

Regarding claim 4, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-type half metallic ferromagnetic semiconductor formed by doping Mn and a hole in a group III-V compound semiconductor, and an n-type half-metallic ferromagnetic semiconductor formed by doping Cr and an electron in

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said group III-V compound semiconductor, which are joined to form a p-n junction type low-resistance TMR diode.

Regarding claim 5, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-i-n type low-resistance TMR diode which includes a p-type half metallic ferromagnetic semiconductor formed by doping Cr and a hole in a group II-VI compound semiconductor, an n-type half-metallic ferromagnetic semiconductor formed by doping V and an electron in said group II-VI compound semiconductor, and at least one atomic layer of nonmagnetic insulator (i-layer) interposed therebetween.

Regarding claim 6, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-i-n type low-resistance TMR diode which includes a p-type half metallic ferromagnetic semiconductor formed by doping Mn and a hole in a group III-V compound semiconductor, an n-type half-metallic ferromagnetic semiconductor formed by doping Cr and an electron in said group III-V compound semiconductor, and at least one atomic layer of nonmagnetic insulator (i-layer) interposed therebetween.

Regarding claim 7, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-i-n type low-resistance TMR diode which includes a p-type half metallic ferromagnetic semiconductor formed of ZnO doped with Cr and a hole, an n-type half-metallic ferromagnetic semiconductor formed of ZnO doped with an electron and either one selected from the group consisting of V, Fe, Co, and Ni, and at least one atomic layer of nonmagnetic insulator (i-layer) interposed therebetween.

Regarding claim 8, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-type half metallic ferromagnetic semiconductor formed of ZnO doped with Cr and a hole, an n-type half-metallic ferromagnetic semiconductor formed of ZnO doped with an electron and either one selected from the group consisting of V, Fe, Co, and Ni, which are joined together to form a p-n junction type low-resistance TMR diode.

Regarding claim 9, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-i-n type low-resistance TMR diode which includes a p-type half metallic ferromagnetic semiconductor formed by doping Fe and a hole in a group IV semiconductor, an n-type half-metallic ferromagnetic semiconductor formed by doping Mn and an electron in said group IV semiconductor, and at least one atomic layer of nonmagnetic insulator (i-layer) interposed therebetween.

Regarding claim 10, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-type half metallic ferromagnetic semiconductor formed by doping Fe and a hole in a substitution position of a group IV semiconductor, an n-type half-metallic ferromagnetic semiconductor formed by doping Mn and an electron in said group IV semiconductor, which are joined together to form a p-n junction type low-resistance TMR diode.

Regarding claim 11, the prior art of record, either singularly or in combination, does not disclose or suggest the combination of limitations including a p-type half metallic ferromagnetic semiconductor formed by doping Mn and a hole in an interstitial position of a group IV semiconductor, an n-type half-metallic ferromagnetic semiconductor formed by doping Cr and

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an electron in said group IV semiconductor, which are joined together to form a p-n junction type low-resistance TMR diode.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### *Conclusion*

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

1. US Pat. 6,445,024.
2. US Pat. 5,962,905.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (571) 272-1731.

The examiner can normally be reached from 8:30 AM - 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and (571) 273-8300 for After Final communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

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may be obtained from either Private or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should any questions arise regarding access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew C. Landau

October 1, 2006

A handwritten signature in black ink, appearing to read 'KENNETH PARKER', with a long horizontal stroke extending to the right.

**KENNETH PARKER**  
**SUPERVISORY PATENT EXAMINER**